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United States Government **Department of Energy**

memorandum

DATE: **June 27, 1994**

REPLY TO ATTN OF: Office of NEPA Oversight:Jessee:6-2410

SUBJECT: Environmental Assessment and Finding of No Significant Impact for the Programmed Improvements of the Alternating Gradient Synchrotron Complex at Brookhaven National Laboratory, Upton, Long Island, New York (DOE/EA-0909)

TO:

Martha A. Krebs
Director
Office of Energy Research

The Office of NEPA Oversight has reviewed the subject Environmental Assessment as requested in a May 10, 1994, memorandum from James K. Farley, the Energy Research NEPA Compliance Officer. On March 11, 1994, the Environmental Assessment was authorized for state/tribal coordination review subject to incorporation of comments. A revised Environmental Assessment was transmitted to the State of New York on March 28, 1994, and on May 5, 1994, the State responded with no comment. On May 25, 1994, the revised Environmental Assessment was submitted to this office for approval.

Based on my staff's review and their recommendation, and after consultation with the Office of General Counsel, I have determined that the proposed action does not constitute a major federal action significantly affecting the human environment within the meaning of NEPA and its implementing regulations (40 CFR Parts 1500-1508). Therefore, the preparation of an environmental impact statement is not required, as described in the attached Finding Of No Significant Impact.

Accordingly, the Environmental Assessment is approved and I have signed the accompanying Finding Of No Significant Impact. The Finding Of No Significant Impact does not need to be published in the Federal Register since this is not an action with effects of national concern. However, the public should be notified of the availability of the Environmental Assessment and Finding Of No Significant Impact in accordance with 40 CFR 1506.6, 10 CFR 1021.322 and DOE Order 5440.1E.

Please provide the Office of NEPA Oversight with an electronic version of DOE/EA-0909, five copies and a record of distribution of the Environmental Assessment and Finding Of No Significant Impact. One copy of the Assessment and Finding should be submitted to the Department's Headquarters Reading Room in the Forrestal Building.

for Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

Attachment

cc: James K. Farley, ER NEPA Compliance Officer
Dr. Bill White, CH NEPA Compliance Officer

U.S. Department of Energy

Finding of No Significant Impact

for

Programmed Improvements

of the

Alternating Gradient Synchrotron Complex

Brookhaven National Laboratory, Upton, Long Island, New York

AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: The Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-0909, evaluating alternatives for proposed upgrades to the existing Alternating Gradient Synchrotron (AGS) Complex at Brookhaven National Laboratory (BNL), Upton, Long Island, New York. The AGS, a circular particle beam accelerator, was originally designed at 33 billion electron volts (Gigaelectron Volts, or GeVs) for protons in 1960. The addition of an AGS Booster in 1991, enabled the AGS to reach proton acceleration intensities of 25 trillion protons or teraprotons (tp) per atomic mass unit at energies of 33 GeV and 11.7 GeV for gold ions. With these capabilities, the AGS is the highest intensity, high repetition proton accelerator in the United States, and the highest energy accelerator for heavy ions in the world. However, over time, the unavailability of replacement parts resulted in loss of beam control, creating radiation hazards to personnel, equipment and the environment, thus preventing continued operation of the accelerator at this intensity. The proposed action is needed to restore AGS beam control and to upgrade the injector system to meet technical specifications for delivery of heavy ions to the BNL Relativistic Heavy Ion Collider (RHIC)(see DOE/EA-0508).

Based upon the analyses in the EA, the DOE has determined that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969 (NEPA). Therefore, the preparation of an Environmental Impact Statement is not required.

DESCRIPTION OF THE PROPOSED ACTION:

The AGS accelerator and experimental system are comprised of four basic units: the particle injection source, the booster accelerating ring, the main accelerating ring, and experimental target areas. Injection sources differ depending upon the particle to be accelerated. The AGS complex consists of 60 buildings providing approximately 56,662 square meters of working space, roughly 16.5 percent of available BNL space. The proposed action includes programmed upgrades to the AGS through 1999, as described in the EA. Specific systems to be upgraded include the radiofrequency (rf) amplifier and cavity, longitudinal damper and ring instrumentation, fast gamma transition jump, vacuum and cooling systems, beam scraper and dump, and power supply.

ALTERNATIVES:

Five alternatives were considered: (1) the proposed action, (2) upgrades necessary to resume safe operations at original design capacity, (3) relocation of investigations to other DOE facilities, (4) no maintenance, and (5) no action. Under alternatives 3, 4, and 5, the AGS would discontinue operation and proceed immediately to decontamination and decommissioning while all experimental activities were relocated to other proton accelerator facilities. Alternative 2 would continue AGS operations at present levels for the next 30 years. The scope of this alternative would not permit the actions necessary to allow the AGS to act as an injector into the RHIC.

ENVIRONMENTAL IMPACTS:

The EA analyzes the potential impacts of programmed improvements of the AGS on the health and safety of workers and the public, as well as to the environment. Areas of potential environmental impact evaluated were air quality, noise, water quality and quantity, aquatic and terrestrial ecology, threatened and endangered species, the visual environment, radiological conditions, and accident scenarios, including those beyond design basis. No significant environmental or health and safety impacts associated with the programmed improvements of the AGS are anticipated. This finding of no significant impact for the proposed action is based on the following factors, which are supported by the information and analyses in the EA.

Impacts of Facility Construction:

Construction activities would be limited to activities within existing facilities. For some upgrades (i.e., utility upgrades), trenching operations could be required to install new utility lines while maintaining service with existing utility lines. This work would typically occur within the existing easements in previously disturbed areas. Concentrations of radionuclides present would not be sufficient to warrant concern associated with direct exposure and ingestion pathways. Calculations indicate that the committed dose equivalent rate to the maximally exposed individual from inhaling soil/dust particles from this area would be 0.00001 millirem per hour, all derived from naturally occurring thorium-228. The maximally affected individual would receive approximately 0.02 millirem per year. This exposure would result in an additional risk of a worker to contract a fatal cancer of less than 0.000002% per year.

Component change-outs as part of equipment upgrades would generate hazardous waste. Replacement of power supplies would require the removal of capacitors containing polychlorinated

biphenyls (PCBs). The removed equipment would generate approximately 40,000 kilograms of PCB waste. Also, the Clean Air Act Amendments require phase out of freon, so disposal of approximately 210 liters of freon would be required. Disposal of freon and PCB waste would be accomplished at an approved off-site facility.

The proposed action would improve proton intensity to 60 tp and increase component reliability. Radiation exposures experienced by maintenance workers would be reduced to 10-15 person-rem per year. Under the proposed action the amount of beam loss would be reduced for maximum operating intensities and energies from 25% to 3%.

Removed radioactive beam line components are packaged at the AGS and stored at BNL's Hazardous Waste Management Facility where they are stored pending final disposal at the DOE/Westinghouse Hanford Facility in Richland, Washington. On the average, BNL transports 27 truckloads of radioactive waste (current generation plus backlog) annually, 60% of which is generated by AGS. Assuming one driver makes all 27 deliveries and does not leave the truck during a five day trip, the driver would receive one rem per year. Such a dose over a 30-year career would increase the potential for contracting a fatal cancer by 2.4%.

Impacts of Facility Operation:

Under the proposed action, operations are expected to be maintained for approximately 20 weeks per year. Discharges of beryllium-7 and manganese-54 would be expected to increase to approximately 60 and 0.8 picocuries per liter, respectively. These discharges would produce an annual committed effective dose equivalent of 0.006 millirem from beryllium-7 and 0.002 from manganese-54 for a total of 0.008 millirem to the affected individual. The additional risk an

affected individual would run in contracting a fatal cancer would be nine chances in one billion.

Many of the secondary particles created near the beam targets are stopped in the soil below the target caves. The types of radionuclides created by these processes are tritium, beryllium-7, carbon-11, nitrogen-13, oxygen-15, and sodium-22. Of these, only the longer lived radionuclides, tritium (half life of 12.3 years) and sodium-22 (half life of 2.6 years), contribute to potential exposure of the BNL and general public populations through ingestion of radiologically contaminated ground water. Under the proposed action, subsequent dose to the maximally affected individual using a potable well located at the site boundary as a sole source of drinking water would be 0.00001 millirem per year. This exposure would decrease under the proposed action.

The secondary particles produced by beam losses interact with the nuclei of nitrogen, oxygen, or argon atoms in air to produce small amounts of radioactivity. Ventilation of the accelerator system does not routinely occur at the AGS complex during normal running periods and would be used only in the event of an emergency; short-lived airborne radioactivity is normally left to decay in situ. Therefore, no impact outside the facility would be anticipated.

BNL policy for nonradiation workers is to restrict the annual dose to less than 25 millirem per year, or 2% of the DOE limit of 500 millirem per year to the maximally affected nonradiation worker/visitor. For off-site personnel, the BNL limit is reduced to 5 millirem or 5% of the DOE allowable limit of 100 millirem from all pathways. Based upon analysis of the maximally exposed individual, it has been determined that BNL limits would be met by ensuring that the planned locations for beam loss have at least 300 centimeters of heavy concrete above them, or the equivalent thickness of other materials. Currently, the experimental areas are typically shielded

with at least 360 centimeters of heavy concrete over target caves and over the switchyard. On the basis of these thicknesses, the AGS experimental areas are designed to produce exposures that would be less than 10% of BNL policy limits under the proposed action.

Calculations performed to determine the total radiation dose to the maximally affected individual residing at the site boundary from AGS operations over a 30 year period would be 15 millirem, largely from sky shine. This dose would be three orders of magnitude below respective background levels. Using risk prediction models, the additional risk of a person residing at the site boundary to contract a fatal cancer would be less than 0.00004% per year.

Impacts of Off-Normal Events:

Abnormal events which could occur during operations would be fire, loss of contaminated cooling water, and beam fault. In the event that a flammable gas is leaked from a cylinder and a spark ignites the gas, the AGS facilities are equipped with fire detection and suppression systems which would immediately activate to control and extinguish a resulting fire. Combustible loading in the experimental areas consists of magnets, power and control cables, and beam diagnostic equipment. None of the materials are highly flammable, and with the possible exception of small amounts of control cable, all would be expected to self-extinguish upon the de-energizing of electric power. Induced radioactivity is deeply entrained in magnets and concrete shielding, and is not dispersible in a fire. Fire/rescue responders could receive direct radiation exposures estimated to be up to 200 millirem per event. This exposure would increase the potential for response personnel to contract a fatal cancer by two chances in ten thousand.

There are no gaseous, liquid, or dispersible quantities of radioactive materials available in AGS

facilities with the exception of the radioactivity induced in magnet cooling water. In primary beam line areas where the cooling water might escape confinement due to failed seals or soft piping, water detection mats underneath the magnets trigger alarms and alert the watch personnel.

Experience has shown that the induced radioactivity in the cooling water systems generally does not exceed 300,000 picocuries per liter for tritium and 3,000 picocuries per liter for beryllium-7, the primary radionuclides of concern. Released water would be accumulated within AGS sump areas, samples would be collected, and depending upon radioactivity present, would be discharged to BNL's sanitary system or collected for disposal through BNL's Waste Concentration Facility depending upon allowances under BNL's SPDES permit.

Based on operating records, beam faults occur when magnet power fails, or when beam line components are misaligned and placed into the beam path. The maximally affected worker in an adjacent area would receive an exposure (all from direct radiation) of 0.00025 millirem per year. The maximally affected individual residing at the site boundary would receive an exposure of 0.00005 millirem per year. There would be no increase in the potential to contract a fatal cancer.

During 1992, the maximum committed effective dose equivalent to an occupant of BNL's site boundary generated by BNL activities was 1.0 mrem of which 0.038 mrem was attributable to the water pathway. The collective population committed effective dose equivalent was 2.6 person-rem of which 0.02 person-rem was attributable to the water pathway. When the combined operation of the proposed action, the proposed Booster Applications Facility and RHIC are considered, the dose to the public would remain statistically insignificant.

Cumulative and Long-Term Impacts:

While the AGS contributes to the cumulative impact of BNL operation on the surrounding environment, the recognizable effects of the proposed action are limited to only minor changes in radioactive and solid waste generation, radiation exposures to occupational workers, and changes in site boundary radiation doses. Because construction and operational changes principally would occur within the developed complex, physical environmental impacts associated with the proposed action or any other of the considered alternatives would be short in duration and/or insignificant.

Under current administrative constraints, the maximally affected radiation worker may potentially receive direct exposure of 1,000 millirem per year. If this individual were to receive this exposure each year over an entire thirty year career, this 30,000 millirem exposure would increase the worker's chances of contracting a fatal cancer by 2.5%. The average exposure to a radiation worker at AGS has been measured to be 40 millirem per year. This exposure rate is expected to decrease marginally under the proposed action. Over a thirty year career, this 1,200 millirem exposure would increase the average persons potential for contracting a fatal cancer by one chance in a thousand. For comparison purposes, the current rate of incidence of contracting a fatal cancer in the general population is approximately one chance in five.

DETERMINATION:

Based on the analyses in the EA, the DOE has determined that the proposed improvements to the Alternating Gradient Synchrotron does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Therefore, an Environmental Impact Statement on the proposed action is not required.

PUBLIC AVAILABILITY: Copies of this EA (DOE/EA-0909) are available from:

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For further information regarding the DOE NEPA process, contact:

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Issued in Washington, D.C., this 27th day of June, 1994.

for Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health